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Planning infrastructure within the Zambezi water-energy-food nexus under uncertainties and climate change

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Water infrastructure development plans will help countries and regions realize the potential of their water resources. Ecosystem preservation, hydropower and irrigation development will contribute to multiple Sustainable Development Goals (United Nations, 2015), such as : End Poverty (1), Zero Hunger (2), Clean and available water for all (6), Clean and affordable energy for all (7) and Sustainable economic growth (8). However, some of these objectives might result in competing water uses, involving multiple stakeholders, upstream-downstream trade-offs and interactions between investments (Bauer-Gottwein et al., 2017). Furthermore, uncertainties related to socio-economic development and future climate add a layer of complexity. This study evaluates the infrastructure investment plans in the Zambezi river basin (World Bank, 2010), based on a hydroeconomic optimization model in a nexus framework (Figure 1). The value of the hydropower development plan is found very sensitive to future fuel prices or carbon pricing policies, the capital costs of solar technologies and climate change. Similarly, the irrigation development plan is found sensitive to the evolution of crop yields, world crop market prices and climate change.

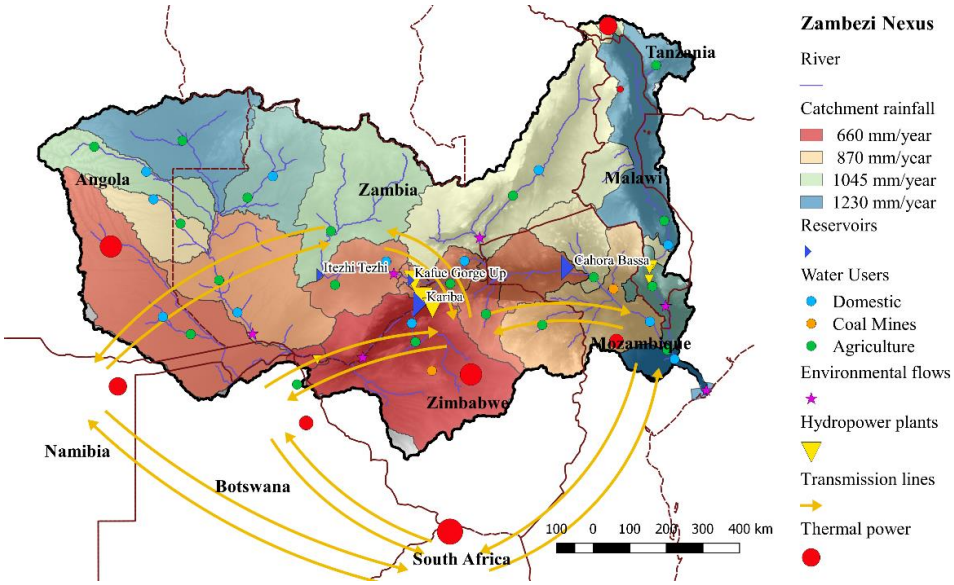

Figure 1: Conceptual representation of the water-energy-food nexus of the Zambezi river basin.

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